

# REPORT DOCUMENTATION PAGE

Form Approved  
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

1. AGENCY USE ONLY (Leave blank)			2. REPORT DATE MAY 1996	3. REPORT TYPE AND DATES COVERED FINAL REPORT (07-1995 TO 12-1996)	
4. TITLE AND SUBTITLE AN ANALYSIS OF THE CONSOLIDATION OF THE BONE MARROW TRANSPLANTATION UNITS OF BROOKE ARMY MEDICAL CENTER AND WILFORD HALL MEDICAL CENTER			5. FUNDING NUMBERS		
6. AUTHOR(S)  LTC MARY C. CONCILIO, DENTAL CORPS					
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)  BROOKE ARMY MEDICAL CENTER			8. PERFORMING ORGANIZATION REPORT NUMBER  3a-96		
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)  US ARMY MEDICAL DEPARTMENT CENTER AND SCHOOL BLDG 2841 MCCS HRA US ARMY BAYLOR PGM IN HCA 3151 SCOTT ROAD FORT SAM HOUSTON, TEXAS 78234-6135			10. SPONSORING/MONITORING AGENCY REPORT NUMBER		
<b>11. SUPPLEMENTARY NOTES</b>  <span style="font-size: 2em; font-weight: bold; margin-left: 10%;">19970501 121</span>					
<b>12a. DISTRIBUTION / AVAILABILITY STATEMENT</b>  APPROVED FOR PUBLIC RELEASE; DISTRIBUTION IS UNLIMITED					
<b>DTIC QUALITY INSPECTED 2</b>					
<b>13. ABSTRACT (Maximum 200 words)</b>  <p>The purpose of this study is to determine whether efficiency and cost-effectiveness of providing bone marrow transplantation (BMT) services will be improved through consolidation of the BMT units of Brooke Army Medical Center (BAMC) and Wilford Hall Medical Center (WHMC). BAMC BMT Unit performed 41 BMT during fiscal year 1995 (FY95) that included 31 adult autologous, 6 pediatric autologous, and 4 pediatric allogeneic transplant patients. Average length of stay (ALOS) was 41 days for adult autologous, 65 days for pediatric autologous, and 72 days for pediatric allogeneic. Average total cost per case was \$77,603. WHMC BMT Unit performed 57 BMT during FY95 consisting of 30 adult allogeneic and 27 adult autologous patients. Average total cost per case was \$65,520 with ALOS of 22 days for adult autologous and 36 days for adult allogeneic. This study supports the recommendation that BMT units at both BAMC and WHMC should be retained. They provide BMT treatment to patients at much less cost to the government than if those cases were treated in civilian hospitals. The study shows that the presence of two BMT units may enhance patient access and decrease the need for referrals into the civilian sector.</p>					
<b>14. SUBJECT TERMS</b>  BONE MARROW TRANSPLANTATION			<b>15. NUMBER OF PAGES</b>  60		
			<b>16. PRICE CODE</b>		
17. SECURITY CLASSIFICATION OF REPORT  N/A	18. SECURITY CLASSIFICATION OF THIS PAGE  N/A	19. SECURITY CLASSIFICATION OF ABSTRACT  N/A	<b>20. LIMITATION OF ABSTRACT</b>  UL		

AN ANALYSIS OF THE CONSOLIDATION  
OF THE BONE MARROW TRANSPLANTATION UNITS  
OF BROOKE ARMY MEDICAL CENTER  
AND WILFORD HALL MEDICAL CENTER

A GRADUATE MANAGEMENT PROJECT  
SUBMITTED TO THE FACULTY OF  
Baylor University  
IN PARTIAL FULFILLMENT OF  
THE REQUIREMENTS FOR THE DEGREE OF  
MASTER OF HEALTH ADMINISTRATION

BY

LIEUTENANT COLONEL MARY C. CONCILIO, DC

MAY 1996

## **ACKNOWLEDGEMENTS**

I want to thank Major Vincent Drady, of the Brooke Army Medical Center (BAMC) Bone Marrow Transplantation Unit, for his information and assistance during the data collection phase of this study. Lieutenant Colonel Linda Yoder, formerly of the BAMC Bone Marrow Transplantation Unit, was also extremely helpful in providing background material about the bone marrow transplantation process and the institution of the unit at BAMC. In addition, I want to extend my thanks to Ms. Sara Lou Leclerc, of Resource Management Division, who obtained the Medical Expense and Performance Reporting System data for me.

## **ABSTRACT**

The purpose of this study is to determine whether the efficiency and cost-effectiveness of providing bone marrow transplantation (BMT) services will be improved through consolidation of the BMT units in the two military medical centers, Brooke Army Medical Center (BAMC) and Wilford Hall Medical Center (WHMC), located in San Antonio, Texas. The BAMC Bone Marrow Transplantation Unit had 41 BMT cases during fiscal year 1995 (FY95). Of these BMT cases, 31 were adult autologous, 6 were pediatric autologous, and 4 were pediatric allogeneic transplant patients. Total average length of stay (ALOS) was 43 days, however, ALOS for adult autologous was 41 days, pediatric autologous was 65 days, and pediatric allogeneic was 72 days. Average total cost per case was \$77,603. Breast cancer cases, which are not reimbursed by the Civilian Health and Medical Program for the Uniformed Services (CHAMPUS), comprised nearly half of the adult cases (14 of 31) with an average total cost of \$63,246 and ALOS of 35 days.

WHMC Bone Marrow Transplantation Unit performed 57 BMT during FY95 consisting of 30 adult allogeneic and 27 adult autologous patients. The total average cost per case was \$65,520 with ALOS of 22 days for adult autologous patients and 36 days for adult allogeneic patients.

This study supports the recommendation that the BMT units at both BAMC and WHMC should be retained. These units are very cost-effective and efficient. They can provide BMT treatment to patients at much less cost to the government than if those cases were treated in civilian hospitals. The analysis does not indicate any economies of scale gained by consolidating the units at one location. The study does show that the presence of two BMT units may enhance patient access and decrease the need for referrals into the civilian sector.

## TABLE OF CONTENTS

ACKNOWLEDGEMENTS .....	ii
ABSTRACT .....	iii
TABLE OF CONTENTS .....	iv
LIST OF TABLES .....	vi
CHAPTER 1 .....	1
INTRODUCTION	
Conditions Which Prompted the Study .....	1
Statement of the Problem .....	7
Literature Review .....	8
Purpose .....	12
CHAPTER 2 .....	14
METHODS AND PROCEDURES	
Data Collection .....	14
Limitations of the Study .....	17
Validity and Reliability .....	17
Ethical Considerations .....	17
CHAPTER 3 .....	18
RESULTS AND MAJOR FINDINGS	
Brooke Army Medical Center Bone Marrow Transplantation Unit .....	18
Wilford Hall Medical Center Bone Marrow Transplantation Unit .....	25
CHAMPUS Average Bone Marrow Transplantation Episode Cost and Total Cost to DoD for the Same Service .....	27

CHAPTER 4 .....	28
DISCUSSION	
CHAPTER 5 .....	40
CONCLUSIONS AND RECOMMENDATIONS	
APPENDIX A .....	43
DEFINITION OF TERMS	
APPENDIX B .....	46
LITERATURE COST ESTIMATE OF AUTOLOGOUS BONE MARROW TRANSPLANT CHARGES EXPECTED FOR TRANSPLANTATION ADMISSION	
APPENDIX C .....	47
BAMC BONE MARROW TRANSPLANTATION UNIT WORKLOAD (FISCAL YEAR 1995)	
APPENDIX D.....	48
BAMC BONE MARROW TRANSPLANTATION UNIT BREAST CANCER CASES (FISCAL YEAR 1995)	
APPENDIX E .....	49
CHAMPUS DATA FOR DRG 481 (BONE MARROW TRANSPLANT) FISCAL YEAR 1993	
APPENDIX F .....	50
CHAMPUS DATA FOR DRG 481 (BONE MARROW TRANSPLANT) FISCAL YEAR 1994	
REFERENCES .....	51

## **LIST OF TABLES**

Table		Page
1.	BAMC Bone Marrow Transplantation Unit Costs .....	19
2.	BAMC Bone Marrow Transplantation Unit Workload .....	21
3.	BAMC Bone Marrow Transplantation Unit Staffing .....	23
4.	WHMC Bone Marrow Transplantation Unit Costs and Workload .....	25
5.	WHMC Bone Marrow Transplantation Unit Staffing .....	26

## **CHAPTER 1**

### **INTRODUCTION**

#### Conditions Which Prompted the Study

The two military medical centers in San Antonio, Texas are Brooke Army Medical Center (BAMC) and the Air Force facility Wilford Hall Medical Center (WHMC). BAMC opened a new hospital in March 1996 which has four hundred fifty beds and about 1.4 million square feet of working space. WHMC has a current operating bed capacity of seven hundred sixteen and is the Air Force's major medical and surgical referral center. These medical centers have the missions of military medical readiness preparation, graduate medical education (GME), and providing medical services to the military population. They also contribute to the treatment of trauma in the civilian community for the San Antonio area.

There has been a rapid change in civilian medicine with the growth of managed care, a shift from inpatient to ambulatory services, a change in focus from subspecialty to primary care GME, and an increased emphasis on university-affiliated hospitals as GME training sites. The military medical environment shares in many of the same changes as civilian medicine. With a downsized and reorganized military, there is a trend toward more of a regionalization of health

care (Task Force Aesculapius 1995). Also, Department of Defense (DoD) Health Affairs has mandated that duplication of GME programs within the various military services in the San Antonio area should be eliminated through integration of similar programs by 1998 (Burkhalter 1996). BAMC and WHMC are responding to DoD pressures for GME integration through cost effective medical service joint ventures. Integration of medical services will strengthen GME programs by sharing physician staff, providing more comprehensive patient populations for teaching purposes, and reducing administrative costs through economies of scale.

Between 1986 and 1994, seven BAMC and WHMC Graduate Medical Education programs were integrated (Tapatio Springs Military Medical Executive Conference 1995). These programs include Emergency Medicine, Urology, Pathology, Ophthalmology, Nuclear Medicine, Infectious Disease, and Critical Care. As of 1995, thirteen duplicate non-integrated military GME programs were still present in San Antonio. The remainder of the GME programs are fairly equivalent so there is no clear advantage for the larger programs to integrate on the basis of GME alone. By forming a health care system and placing integrated GME programs in the most logical location, BAMC and WHMC can consolidate specialized services to improve efficiency and share monetary resources and personnel. This will also decrease political vulnerability by making both medical centers more cost effective.

In the situation analysis of GME integration between BAMC and WHMC,

there are some restraining forces. The University of Texas Health Science Center at San Antonio is being established as a coordination point for a military medical education office for BAMC and WHMC (Tapatio Springs Military Medical Executive Conference 1995). That office, under the University auspices, would coordinate both GME activities at the regional military hospitals and regional cooperative research. A similar consortium for medical care, with one leadership group managing all GME programs, has been successfully used in the Buffalo, New York area (Naughton and Vana 1994).

There is some concern that there may be loss of program director autonomy or that a new layer of bureaucracy may be created by going through a military liaison office. However, there are other driving forces that are making this a necessity. Close ties between the San Antonio military medical centers and the civilian community are required to meet the trauma care needs of San Antonio (Tapatio Springs Military Medical Executive Conference 1995). Also, both military medicine and the Health Science Center face the same constraints in the current medical environment. The use of capitation budgeting in the managed care arena emphasizes primary care, preventive medicine, and a change of flow patterns for patient populations. By interlocking the health care systems in the San Antonio area, different population bases are maximized and it eliminates underutilized or duplicated services.

Another consequence of managed care, with the move towards primary care, has been a revision of specialty GME programs. There has been a trend to

decrease both the number of programs and the overall generalist versus specialty distribution of the residents training in the programs (Kindig and Libby 1994). It appears that university-based programs may have some advantage in this process. The integration of the BAMC and WHMC GME programs, with a university affiliation, is a proactive response to that action. In addition, integration of GME offers opportunities to achieve optimal numbers of faculty on the various services.

There are also some military specific driving forces that are encouraging both GME integration and university affiliation in the San Antonio area. DoD Health Affairs has strongly subscribed to the concept of San Antonio military GME integrating with the Health Science Center (Tapatio Springs Military Medical Executive Conference 1995). Both the Air Force and the Army are experiencing a significant medical drawdown which will inevitably influence overall military GME output. Linkage of military GME with a university medical program in the San Antonio community will help ensure a continuation of military GME in that area.

Several military GME programs have already integrated between BAMC and WHMC, and other services are in the process of developing plans for a combination of duplicate programs in the near future (Tapatio Springs Military Medical Executive Conference 1995). No significant efficiencies could be found in integrating either Internal Medicine or General Surgery GME programs so separate residency programs in those specialties will be maintained at BAMC and WHMC. One service which has posed some problems for the GME integration

plan has been the Hematology/Oncology Service. This is due to several reasons but one of the most significant centers on the fact that Bone Marrow Transplantation (BMT) Units, which are a part of this service, currently exist at both medical centers and each facility currently wants to retain its BMT capability (Tapatio Springs Military Medical Executive Conference 1995).

At the present time, WHMC performs adult allogeneic and autologous BMT while BAMC does both pediatric allogeneic and autologous BMT and adult autologous BMT. WHMC has been designated as a Specialized Treatment Service (STS) for adult BMT (Allerton and Lewis 1995). STS facility requirements include clinical excellence, experience and outcomes tracking, complexity of care, and cost savings demonstrating that total government cost is less than the Civilian Health and Medical Program for the Uniformed Services' (CHAMPUS) costs (Dunn 1995).

Several alternative proposals concerning integration of the Hematology/Oncology Services of BAMC and WHMC were presented at the Tapitio Springs Military Medical Executive Conference in August 1995. This meeting was attended by key medical, nursing, and administrative staff from both hospitals. WHMC currently has three fellows starting each year for a total of nine fellows in their Hematology/Oncology program whereas BAMC has two fellows beginning in their fellowship program yearly for a total of six fellows in that program. The proposed integrated Hematology/Oncology Department would have a total of fifteen fellows. The BAMC and WHMC Hematology/Oncology departments

investigated various methods of producing an optimum integration of the programs and presented their recommendations at this conference.

The first proposal for integrating the two services locates all cancer treatment, both surgical and medical, in one hospital with a small consult service and clinic at the other site and also integrates the training programs. The advantages of this alternative would be the creation of a cancer center concept, a possible cost savings, convenience for patients, and having all continuity clinics in one building. The disadvantages of this plan are that a large number of departments would be involved, there would be a lack of oncology support at the secondary hospital, and it would be inconvenient to about half the patients who live closer to the medical center without the services.

A second proposal placed the cancer center concept at both medical centers. All adult BMT services would be done at WHMC but otherwise full Hematology/Oncology services could be present in both hospitals and the training programs would be integrated. The advantages of this proposal are savings from concentrating expensive BMT assets in one location, less upheaval for non-Oncology departments than with the first plan, and the ability to provide full oncology services at both hospitals. The disadvantages are that there could be a potential effect on other medicine subspecialties by not having a sufficient number of referrals as a result of this plan and it might have an effect on fellow rotations at the continuity clinics. The third plan is the same as the second except that there would only be close affiliation, but not integration, of the training

programs. This last proposal would not comply with the DoD directive to combine duplicate GME programs.

The plan agreed to by the Commanders of BAMC and WHMC was a combination of these proposals (Tapatio Springs Military Medical Executive Conference 1995). The Hematology/Oncology services at WHMC and BAMC will merge with an integration of the fellowship programs. Medical Hematology/Oncology, possibly including the BMT units, would be placed at BAMC while surgical oncology will continue to be done at both medical centers.

There are many factors to be considered in the integration of the Hematology/Oncology services of WHMC and BAMC and one of the most controversial is the placement of the entire consolidated BMT unit at BAMC. The Hematology/Oncology service of WHMC believes that the new BAMC facility will not be equipped with either appropriate staff or physical design to support a suitable BMT unit. Since the BMT unit is a major point of contention, it will be focused on as the area of interest to analyze. The multiple integration issues that will be studied include resource management of both personnel and finances, administration concerns, space availability for the unit in the new BAMC, ancillary support within the service, laboratory support, availability of hospital staff from other services, and required nursing staff for the BMT unit.

#### Statement of the Problem

BAMC and WHMC are presently involved with the integration of several of their GME programs. The integration of the Hematology/Oncology Service

fellowship program is being impeded because of controversy over the placement of the BMT unit at BAMC. This study attempts to answer the following question: Will BAMC and WHMC be more cost-effective and efficient in providing BMT services to eligible military beneficiaries either by totally consolidating the BMT units of BAMC and WHMC at one facility or by providing BMT treatment at both hospitals?

#### Literature Review

Maynard, Lagerwey, Wendling, and Kindig (1995) state that the most common reasons given for institutional consolidation are to decrease duplication of services, expansion of new services, and financial objectives which include economies of scale and cost savings. That study found that consolidation of clinical departments was the most difficult area and was caused by two factors. First, the closure of a unit at one of the two institutions caused physicians to rally to protect their own unit. The second issue involved the degree of competition between physicians of the consolidating hospitals. Consolidation is prolonged when the physicians are highly competitive and practice different styles of medicine. Mergers may pose a threat to physicians as well as to established clinical networks among the medical staff (Riffer 1986). Additionally, Holoweiko (1995) warns that cultural issues are great and that both sides need to go into a merger with the expectation that it might take several years to begin functioning as a single unit. However, Eiseman (1995) states that for many years DoD has gradually unified the medical programs of the Army, Navy, and Air

Force and that while each service provides patient care interchangeably with its sister services, each service still maintains its own identity because of unique military missions. He also asserts that major macroeconomic savings are achieved by avoiding inefficient duplication of efforts.

Graduate medical education must be approached from the premise that uneconomic duplications should be minimized. The total cost of GME includes not only the direct costs of administrative expenses but also the indirect costs of more costly services provided to patients as a result of the teaching function. University teaching hospitals were found to be about a third more costly than nonteaching hospitals for the same mix of patients and major teaching hospitals (not university affiliated) were 18 percent more costly than nonteaching hospitals (Cameron 1985). Boex (1992) suggests that institutions with more and larger training programs have lower resident costs than those with smaller programs through maximizing efficiencies with economies of scale. Diamond, Fitzgerald, and Day (1993) also contend that expanding the size of existing medical residencies could provide increased revenue to the institution.

The BMT unit provides essential training to the Hematology/Oncology fellows. Leff, Thompson, and Messerschmidt (1988) believe that as BMT becomes more extensively applied and accepted as the standard of care for selected diseases, the need for the DoD military-medical complex to provide transplantation services has grown. The Army-Navy Transplant Service at Walter Reed Army Medical Center was described by Fernandez-Bueno, Shaver, and

Baker (1990). They noted that the superior clinical results and major roles that their service played in GME makes continued support and expansion of military transplantation compelling. They also advocated the importance of developing clinical centers of excellence in military medicine. Additionally, CHAMPUS is spending millions of dollars annually to provide military beneficiaries with transplants in civilian institutions. The ability to treat these patients in military facilities is economically cost effective for the government (Fernandez-Bueno, Shaver, and Baker 1990).

BMT is recognized as an effective treatment for several types of cancer and certain other diseases. Allogeneic, autologous, and syngeneic are the three types of BMT. Allogeneic BMT involves the transfer of marrow from a donor to another person and is called syngeneic BMT when the donor and recipient are identical twins. In contrast, autologous BMT uses the patient's own marrow (Armitage 1994). About 12,000 BMTs were performed in 1992, of which approximately half were allogeneic and half were autologous (National Cancer Institute 1994).

BMT is a costly procedure with many patient care challenges due to long duration of care, high acuity of inpatient care with a mean length of stay of 37.8 days, complex pathophysiology, fragile state of the patient, and severe financial and social pressures on the family (Giles, Winslow, and Vaughan 1994). An estimate of the approximate cost of autologous BMT is about \$125,000 per patient (Schwab 1991). However, although BMT has very high costs in the first

year compared with conventional chemotherapy treatment, it has low costs in subsequent years for those individuals who survive the initial treatment (Lie 1994). Griffiths, Bass, Powe, Anderson, Goodman, and Wingard (1993) also note that although considerable progress has been made over the past decade in reducing inpatient costs associated with allogeneic BMT, complications with infections continue to be associated with considerable additional costs.

Another area of concern is that BMT is still considered to be an experimental treatment for some cancers. A study by Hillner, Smith, and Desch (1992) indicated that autologous bone marrow transplantation in metastatic breast cancer had a survival benefit of an additional six months at five years at an incremental cost of \$115,800 per year of life saved. As a corollary to this, Wingard (1994) notes that some insurance plans have specifically excluded BMT treatment for breast cancer. Peters and Rogers (1994) reported that requests for insurance coverage for autologous BMT, as treatment for breast cancer, were approved in 77% of the cases and the remainder were denied primarily because the therapy was considered experimental. Consequently, areas of debate about the BMT procedure include that it is an expensive technology with variable success rates and it presents some ethical considerations.

In addition, BMT units have designated staffing and facility requirements to enable appropriate care for their patients. Areas to be considered for optimal performance of the unit are adequate patient volume, facilities specific for transplant treatment, trained physician and nursing personnel, and adequate

ancillary staff (Whedon 1991). BMT units have significant impact on the clinical laboratories which support the unit by greatly increasing their procedure volume (Markin 1992).

Cost-effectiveness analysis (CEA) and cost-benefit analysis (CBA) are the two analytic techniques that are generally used to evaluate health care technologies and practices (Udvarhelyi, Colditz, Rai, and Epstein 1992). Warner and Hutton (1980) state that these analyses allow a comparison of the significant positive and negative consequences of alternative programs. However, whereas CBA can be used to compare very different types of actions, such as using resources to construct a dam or construct a hospital, CEA permits comparison of alternatives serving the same basic purpose. Thus, the literature suggests that a CEA of the total BMT unit requirements, including direct and indirect costs, would be the method of choice for determining whether any cost and personnel efficiencies are gained through an integration of the BAMC and WHMC BMT units.

#### Purpose

The purpose of this study is to determine whether the efficiency of providing BMT services to eligible military beneficiaries in the San Antonio area, the Health Service Support area for BAMC, and at a national level for BMT that has STS status, will be improved by consolidating the BMT units of BAMC and WHMC or by retaining both units to provide BMT. The nature of this study requires both a quantitative cost effectiveness analysis as well as a qualitative

analysis of issues which are a part of this overall topic. Qualitative issues that influence BMT include the capability of the facilities to provide optimum BMT services as well as the influence of BMT integration on other medical and surgical services within the two hospitals.

The quantitative part of this study will analyze cost effectiveness achieved through integration of the BMT units in the following areas: 1) patient volume and types of patients treated, 2) current costs of operating the present BMT units at WHMC and BAMC, 3) a comparison of the anticipated cost of continuing separate BMT units at BAMC and WHMC with consolidation of the units into one military BMT unit for the San Antonio area, 4) current costs of CHAMPUS for BMT and CHAMPUS recapture initiatives that have been accomplished, and 5) implications of maintaining STS status for adult and pediatric BMT.

## **CHAPTER 2**

### **METHODS AND PROCEDURES**

#### Data Collection

The research design for this study has been adapted from the descriptive research approach recommended by Isaac and Michael (1981). This method allows for comparisons and evaluations, such as required in this economic study, where statistical analyses are not practical. The quantitative analysis follows the cost-effectiveness analysis procedures noted in the literature previously discussed. The qualitative issues will be addressed in the discussion section of the paper.

The cost effectiveness analysis for this study involves several different areas of investigation. The first one involves total governmental costs in the catchment area of providing care for BMT patients. This entails obtaining actual detailed direct and indirect cost data for BAMC BMT unit and WHMC BMT unit to determine total average cost per BMT case. Coupled with this cost data is the workload information and funding concerning BMT which is accumulated in management reports from the Medical Expense and Performance Reporting (MEPR) System. MEPR was established through DoD policy to maintain a uniform expense and manpower reporting system in all fixed military medical treatment facilities in order to provide standardized data for management of health

care resources (Assistant Secretary of Defense Health Affairs 1986).

The next area of interest are future costs of providing BMT in an integrated unit. This study will consider different alternatives which could potentially reduce costs through economies of scale resulting from a consolidation of the units. Efficiencies could be realized through integration of the medical staff, nursing personnel, ancillary staff and services, better utilization of facilities space, and avoiding duplication of similar services and costly technology. The third consideration will be an analysis of the advantages and disadvantages of retaining STS status for the BMT units. Finally, qualitative issues that include patient access, influence of GME teaching requirements, interrelationships with other medical or surgical services, other hospitals in the San Antonio area that provide BMT treatment, and continuation of CHAMPUS recapture initiatives could influence costs or patient treatment and will be discussed.

The analysis will show the current costs of providing BMT therapy to eligible beneficiaries at BAMC and WHMC as a direct consequence of the number of services received and indirect costs of operating the unit. A comparison will be made using expected costs of providing the same volume of BMT services if an integration of the units occurred. A comparison of the two costs is an indication of the any cost efficiencies obtained through the consolidation of the BAMC and WHMC BMT units.

Information about CHAMPUS expenditures for eligible patients who received BMT in the BAMC or WHMC catchment areas or CHAMPUS

recapture or cost avoidance initiatives, which are monitored by the Coordinated Care Division, will be obtained from the CHAMPUS database and the Tri-Service CHAMPUS Statistical Database Project (TCSDP). Additionally, historical data on BMT has been reported by Optenberg and Thompson (1993) in a TCSDP describing allogeneic and autologous BMT in CHAMPUS from 1989 to 1993.

The Resource Management Division is another source of data regarding budgetary information on the costs of operating the BMT units. Resource Management at BAMC is the main resource allocator for the BAMC BMT unit and can give resources utilized by that unit. Since WHMC BMT unit receives its funding from the Air Force, information on that facility will be procured directly from them.

BMT staffing levels and workload are maintained by the nurse managers of the individual BMT units. The nurse manager at the BAMC BMT unit has analyzed facilities design and space requirements at the new BAMC hospital for the consolidated BMT unit and is an additional source of information about funding and staffing levels for the unit. Additionally, the MEPR section of Resource Management Division at BAMC has provided both workload and actual expenditures for direct and indirect costs within the present BAMC unit in order to assist with future cost projections at the new BAMC. Requirements for attaining STS status are listed in the *Federal Register* (1993) and will be used to determine the cost effectiveness of the BMT units as specialized treatment services at both BAMC and WHMC.

### Limitations of the Study

Since this study involves the use of data from several different sources, all cost and patient admission data will be obtained from the same fiscal year for more accurate comparison. Fiscal year 1995 (FY 95) will be used as the base year for all information used to draw conclusions in this management project. Previous years' data may be referred to in order to show certain possible trends in resource utilization.

### Validity and Reliability

The validity of the collected data will not involve statistical criteria as this study centers around required and available financial or workload data acquired from the Resource Management Divisions and the BMT units of BAMC and WHMC. This data is assumed to be reliable due to the nature of the sources of the data.

### Ethical Considerations

There was no direct experimental or other contact with particular subjects in this study, only database information concerning financial data, staffing, and workload for the BMT units, so there was no threat of unethical activity.

## **CHAPTER 3**

### **RESULTS AND MAJOR FINDINGS**

#### **Brooke Army Medical Center Bone Marrow Transplantation Unit**

The official name of the BAMC BMT unit is the General Maxwell R. Thurman Bone Marrow Transplantation Unit dedicated on 19 July 1993. This BMT unit was initially started as a CHAMPUS recapture initiative of the Coordinated Care Division at BAMC. The study by Optenberg and Thompson (1993) showed that BMT care within CHAMPUS resulted in very extensive billings and payment per case regardless of the type of BMT. A query of CHAMPUS BMT charges by BAMC Coordinated Care Division supported those findings (Oglivie 1993). In their investigation of BMT CHAMPUS data through the Financial Analysis Support System (FASS), they reported an average cost of approximately \$150,000 per case. Therefore, the BAMC BMT unit was developed as a cost-saving program to decrease the huge CHAMPUS payments for bone marrow transplants and related procedures.

The cost of operating the BAMC BMT unit is an aggregate of both direct and indirect operating expenses. Direct costs are comprised of expenses from civilian and military personnel, training, supplies, contracts, and travel. Indirect costs are the total costs from ancillary services and support accounts. The ancillary services most utilized by the BMT unit are pharmacy, blood bank, clinical

investigation, radiology, nutrition care, and operating room. The support services involve housekeeping, linen services, biomedical repair, and services involved with plant management. Costs are computed using a step-down cost accounting method that allocates all associated costs to a particular cost-center within the facility in order to determine a total patient episode of BMT treatment. Information obtained from the BAMC BMT unit reflect all Fiscal Year 1995 (1 October 1994 to 30 September 1995) actual expense obligations for the BAMC BMT unit for that time period and are listed in Table 1. Since that unit was initially set up as a CHAMPUS recapture initiative, the expenses are reported based on whether the BMT patients are CHAMPUS eligible or CHAMPUS non-eligible for BMT treatment.

---

#### BAMC Bone Marrow Transplantation Unit Costs

Fiscal Year 1995

<u>Expense</u>	BMT/ <u>CHAMPUS</u>	BMT/NON- <u>CHAMPUS</u>	Total Costs	Cost Per Patient
Personnel	\$ 699,655	\$ 712,089	\$1,411,744	\$ 34,433
Pharmacy	257,050	266,640	523,690	12,773
Supplies	70,576	72,344	142,920	3,486
Blood Bank	71,254	50,825	122,079	2,978
Radiology	25,591	23,059	48,650	1,187
Laboratory	11,450	11,948	23,398	571
OR	9,419	11,116	20,535	500
Training	2,149	1,890	4,039	98
Nutrition Care	915	944	1,859	45
<u>Indirect Costs</u>	<u>464,374</u>	<u>418,458</u>	<u>882,832</u>	<u>21,532</u>
<b>TOTAL</b>	<b>\$1,612,433</b>	<b>\$1,569,313</b>	<b>\$3,181,746</b>	<b>\$ 77,603</b>

---

**Table 1. BAMC Bone Marrow Transplantation Unit Costs**

The rank order of direct costs per BMT patient shown in Table 1 is very similar to that described in the literature by Whedon (1991) which is listed in Appendix B. However, the overall total costs per BMT case (\$77,603) at BAMC are significantly lower than the estimated average total BMT costs in the civilian sector (\$138,698).

The number of total BMT dispositions, or patients discharged from that unit of the hospital, during FY95 is the number used by the MEPR system to determine unit stepdown expenses and unit cost per disposition. MEPR reported that there were 41 total dispositions from the BAMC BMT unit during FY95. This is based on the MEPR code of AAQ which represents the BMT program workload and expenses. This MEPR code for FY95 contained the following diagnosis related groups (DRG) which were treated in this BMT unit: DRG 481 Bone marrow transplant, DRG 467 Other factors influencing health status, DRG 405 Acute leukemia without major operating room procedure age 0-17, DRG 269 Other skin or subcutaneous tissue and breast procedure with complications (CC), DRG 403 Lymphoma and non-acute leukemia with CC, DRG 174 Gastrointestinal hemorrhage with CC, DRG 396 Red blood cell disorders age 0-17, DRG 401 Lymphoma and non-acute leukemia with other operating room procedure with CC, DRG 402 Lymphoma and non-acute leukemia with other operating room procedure without CC, DRG 404 Lymphoma and non-acute leukemia without CC, DRG 410 Chemotherapy without acute leukemia as a secondary diagnosis, DRG 415 Operating room procedure for infectious and parasitic diseases, and DRG 468 Extensive operating room procedure unrelated to principal diagnosis. BAMC BMT unit performed both autologous (6)

and allogenic (4) pediatric BMT but only autologous (31) adult BMT as is shown in Appendix C.

MEPR reported a total cost of \$3,033,175 for FY95 for the principal diagnosis of DRG 481 (Bone marrow transplant). The MEPR system also tracks occupied bed days which are the total number of bed days used by the unit during the fiscal year. In addition, the medical work units (MWU), which are an indication of workload, can be determined by multiplying the number of dispositions by the specific hospital value factor (for BAMC this value is 1.5868). The dispositions and workload from MEPR are summarized in Table 2.

---

BAMC Bone Marrow Transplantation Unit Workload  
MEPR Code (AAQ)  
Fiscal Year 1995

<u>Month</u>	<u>Inpatient Dispositions</u>	<u>Average Length of Stay (ALOS)</u>
October	4	42
November	3	45
December	4	39
January	3	50
February	3	51
March	3	57
April	3	49
May	4	38
June	5	27
July	1	149
August	6	20
<u>September</u>	<u>2</u>	<u>66</u>
<b>TOTAL</b>	<b>41</b>	<b>43</b>

**Total Occupied Bed Days = 1760**  
**Medical Work Units (MWU) = 65**

---

**Table 2. BAMC Bone Marrow Transplantation Unit Workload**

The average length of stay (ALOS) can be calculated for each MEPR code by dividing the total occupied bed days by the total number of dispositions. The ALOS, according to the MEPR system, for the entire BMT unit for FY95 was 43 days. However, this number also includes patients that were on the unit for workup, bone marrow harvesting, or followup. When analyzing patients that actually received BMT during FY95, the ALOS (lengths of stays are shown in Appendix C) were calculated as 41 days for adult autologous BMT patients, 65 days for pediatric autologous BMT patients, and 72 days for pediatric allogeneic BMT patients.

The number of patient dispositions from the BMT unit will be used as an accurate representation for workload in all cost effectiveness analysis calculations since that is what the MEPR system uses. The total average cost of providing a complete episode of patient care for a BMT hospitalization is calculated by dividing the total direct and indirect costs for the BMT unit by the total number of dispositions for FY95. The actual total costs for the BMT unit listed in Table 1 will be used in this calculation.

$$\frac{\$3,181,746 \text{ Total BMT unit costs}}{41 \text{ Dispositions}} = \$77,603 \text{ Average cost per BMT case}$$

If this same method is used on similar groups of BAMC BMT patients, average cost per case for adult autologous BMT patients is \$68,833, pediatric autologous patients is \$103,339, and pediatric allogeneic patients is \$106,968.

The manpower staffing assessment model is used by the U. S. Army Medical Command to determine the optimum staff needed to provide medical care and support functions for the population served. The model develops the staffing profile

by evaluating the "benchmark time" per occupied bed day for each major specialty. The benchmark time is defined as the most efficient time to perform nursing care for a bed day. The performance unit times data from the "most efficient group" of Army medical treatment facilities produced the benchmark times (Manpower Modeling and Requirements Branch 1994). The manpower staffing assessment was conducted at BAMC in July 1994. It found that the BAMC BMT unit (MEPR Code AAQ) had 20.489 full time requirements for staffing based on 148 monthly occupied bed days.

The Joint Healthcare Manpower Table (Joint Healthcare Manpower Development Study 1992) uses the staffing determination from the assessment model to predict the appropriate amount of inpatient nursing services for a unit. A staffing assessment of 20 to 22 produces manpower requirements of eight to nine registered nurses, eleven paraprofessionals, and one to two administrative support people. Although the BMT unit in BAMC is an eight bed unit, it is currently only staffed for six beds. The BMT unit staff approximate the requirements indicated by the manpower study and are listed in Table 3.

---

BAMC Bone Marrow Transplantation Unit Staffing  
(As of 29 February 1996)

<u>Position</u>	<u>Grade</u>
1 Head Nurse	Major (O-4)
8 Registered Nurses*	GS-11
9 Vocational Nurses	GS-06
2 Ward Clerks	GS-04
1 Nursing Assistant	GS-04
1 Budget Analyst	GS-07
1 Wardmaster	Staff Sergeant (E-6)
1 Social Worker	Contract

\* 2 additional Registered Nurses are currently being hired

---

**Table 3. BAMC Bone Marrow Transplantation Unit Staffing**

Note: The Bone Marrow Laboratory is part of the Department of Clinical Investigation and is not considered in the staffing requirements for the BMT unit. Pharmacy Service has one Pharmacist assigned to the Hematology/Oncology Service but this person is not part of BMT staffing requirements.

BAMC had received Specialized Treatment Services (STS) program status for pediatric BMT. However, Pediatric inpatient services are relocating to WHMC as part of the consolidation of the GME programs. Because of this, the support staff for pediatric BMT will no longer be available at BAMC and all pediatric BMT (both autologous and allogeneic) will eventually be done at WHMC.

BAMC recently applied for STS designation for high-dose chemotherapy with autologous stem cell rescue (BMT) for breast cancer. As was noted previously in the literature review, BMT for breast cancer is still considered an experimental procedure by some insurance companies and they will not provide insurance coverage for BMT with that diagnosis. At the present time, there is no CHAMPUS reimbursement for BMT as a treatment for patients with breast cancer (CHAMPUS Policy Manual 1991). For that reason, almost half (14 out of 31 for FY95) of all adult transplants done at BAMC are for breast cancer patients as is depicted in Appendix C. BAMC has received referrals from all regions of the military health care system and has developed special expertise in the area of BMT for breast cancer. The BAMC STS application anticipates that the expected number of BMT for breast cancer will be approximately twenty per year based on the current referral pattern and the actual number of transplants performed in the last fiscal year. The average

total cost for a BAMC BMT case for breast cancer, as determined from the direct (\$44,829) and indirect (\$16,772) costs for FY 95 (Appendix D) plus average travel costs (\$3,864), is \$65,465. In FY95, the ALOS for breast cancer cases was 35 days.

Wilford Hall Medical Center Bone Marrow Transplantation Unit

WHMC BMT unit has been previously designated as a STS for adult BMT. That BMT unit performed a total of fifty-seven transplants in FY95 which consisted of thirty adult allogeneic BMT and twenty-seven adult autologous BMT. During FY95, eighteen adult allogenic BMT patients, two adult autologous BMT patients, and ten pediatric allogenic BMT patients were also sent out to CHAMPUS for treatment. Although WHMC performed only adult BMT during FY95, the BMT unit has the space and personnel to increase the number of adult BMT and absorb the pediatric BMT workload. Statistics concerning the workload generated and costs of the WHMC BMT unit are listed in Table 4.

---

WHMC Bone Marrow Transplantation Unit Costs and Workload

Fiscal Year 1995

Current Capacity	13 beds
Room for Expansion	10 beds
Allogenic BMT	30 cases
Autologous BMT	27 cases
ALOS Allogenic BMT	36 days
ALOS Autologous BMT	22 days
Total Occupied Bed Days	1696 bed days
Total Dispositions	57 patients
Average cost per case	\$65,520

---

**Table 4. WHMC Bone Marrow Transplantation Unit Costs and Workload**

The WHMC BMT unit is a thirteen bed ward with high efficiency particulate air filters (HEPAfilters) in all transplant patient rooms and an additional ten HEPAfiltered rooms currently available for expansion. The unit also has laminar airflow in two of the rooms on the BMT ward. The manpower staffing for the WHMC BMT unit is listed in Table 5.

---

#### WHMC Bone Marrow Transplantation Unit Staffing

<u>Position</u>	<u>Grade</u>
1 Nurse Manager	LTC (O-5)
1 Assistant Nurse Manager	GS-11
1 Clinical Nurse Specialist	GS-11
18 Staff Registered Nurses	GS-11
4 Apheresis (Therapeutic/Collection)	GS-11
1 Social Worker	GS-12
1 Patient Referral Coordinator	GS-07
1 Patient Referral Coordinator	GS-05
1 Administrative Asst. in Charge	GS-05
3 Technician/Supply/Dietary Asst.	GS-05
1 Secretary	GS-04
1 Ward Clerk	GS-04
1 Blood Bank Coordinator	Contract
1 Computer Programmer	Contract
1 Clinical Pharmacist	Captain (O-3)
3 Clinical Pharmacist	GS-11
1 Pharmacy Technician	GS-05
1 Special Hematology	GS-09
1 Immunology - HLA	GS-11
1 Immunology	GS-09
2 Microbiology	GS-11
1 Microbiology	GS-09
1 Chemistry	GS-09
1 Histocompatibility Lab	GS-11

**Table 5. WHMC Bone Marrow Transplantation Unit Staffing**

The recommended staffing ratio of nurses to allogeneic BMT patients is a 1:2 ratio and the optimum nurse staffing for autologous BMT patients is a 1:3 ratio. This different staffing ratio is a result of the higher acuity of allogenic BMT patients due to their greater propensity for complications requiring more nursing care (Armitage 1994). WHMC had approximately a ratio of half allogeneic and half autologous BMT patients during FY95 and had the appropriate manpower staffing to meet the required patient care needs. However, if WHMC BMT unit begins to perform pediatric BMT, the unit estimates that it will require six pediatric specialized nurses to provide care for approximately the twenty-one pediatric BMT patients (based on total FY95 numbers for pediatric BMT patients).

CHAMPUS Average Bone Marrow Transplantation Episode Cost and Total Cost to DoD for the Same Service

CHAMPUS cost data for FY95 was not yet available so data from the previous two years will be used as estimates of CHAMPUS costs. CHAMPUS costs for CHAMPUS-eligible diagnoses for BMT (DRG 481 Bone Marrow Transplant) were obtained for Fiscal Year 1993 (FY93) and Fiscal Year 1994 (FY94) from the Defense Medical Information System (DMIS Information Center, CHAMPUS Data Integration Project). The CHAMPUS data procured for FY93 showed a total of 29 adult BMT cases for an average episode billed amount of \$215,632 and an average government cost of \$108,771 (Appendix E). CHAMPUS data received for FY94 gave a total of 39 adult BMT cases for an average episode billed amount of \$232,403 and an average government cost of \$176,548 (Appendix F).

## **CHAPTER 4**

### **DISCUSSION**

A directive from DoD Health Affairs has mandated that duplication of GME programs at BAMC and WHMC must be eliminated through integration of similar programs. Between 1988 and 1995, nine duplicated GME programs at BAMC and WHMC were integrated. In 1995, thirteen duplicated, unintegrated GME programs still remained. These remaining GME programs were strong at both institutions so service consolidations and efficiencies were evaluated and then the programs were sited at the facility that could best accommodate them. The BMT units at each institution, as part of the Hematology/Oncology Services, were also evaluated in the same manner to determine where the optimum cost-effectiveness and efficiencies could be gained.

After extensive analysis and discussion between the services at both medical centers, the following agreements regarding the integration of GME programs at BAMC and WHMC were reached. The Transitional Program, Internal Medicine, and General Surgery GME programs will not be integrated. Three medical subspecialty training programs, which include Pulmonary, Hematology/Oncology, and Cardiology, will be integrated under the BAMC Internal Medicine Program. Gastroenterology will be integrated under the WHMC Internal Medicine Program.

The remaining six GME programs will integrate through the University Office of University/Military GME Coordination which was previously discussed.

The merger or relocation of the BMT units of BAMC and WHMC, as part of Hematology/Oncology Service, is being examined in order to improve the efficiency and cost-effectiveness of military BMT services in the San Antonio area. Both BAMC and WHMC have developed successful BMT programs. Uniting these programs at one hospital may not necessarily result in improved cost-effectiveness. It could potentially increase the cost of providing BMT services to DoD beneficiaries if not all patients needing transplants are able to access a single BMT unit due to space constraints.

BMT technology is being applied to an increasing number of patients for a variety of diagnoses. In addition to the present BMT units at BAMC and WHMC, the four other hospitals in San Antonio that have BMT units include Audie Murphy Veterans Administration Hospital, University Hospital, Methodist Hospital, and Santa Rosa Children's Hospital. These San Antonio hospitals primarily treat BMT patients from a local and regional referral base.

BMT is an expensive medical procedure and the CHAMPUS costs that were billed and paid for BMT treatment (listed in Appendix E and Appendix F) attest to this fact. The Optenburg and Thompson (1993) study referred to previously gives historical data on CHAMPUS costs for BMT procedures from 1989 to 1993 . That report states that, "it is clear that bone marrow transplantation care within CHAMPUS results in very extensive billings and payments per case regardless of

type of bone marrow transplant (Optenberg and Thompson 1993)."

The BMT units were initially going to be consolidated at BAMC as a consequence of the Hematology/Oncology GME program being placed there. However, this caused some concern to the WHMC oncologists because of the size, staffing, and ancillary support of the BAMC unit. Therefore, this study evaluated three possible actions that could occur concerning the placement of the BMT units. The first alternative is that the two BMT units could be consolidated at BAMC as originally planned. The second alternative is that both units could be consolidated at WHMC instead. The third possibility is that both units could remain in their present locations at BAMC and WHMC. The cost-effectiveness, staffing, ancillary services, and medical support for each option will be reviewed.

The first alternative examines the feasibility of consolidating both BMT units at BAMC. The cost of doing a BMT at BAMC is a combination of the actual total direct and indirect operating costs per BMT patient. The BMT program at BAMC has routinely monitored costs and workload since the BMT unit was started as a CHAMPUS demonstration project in 1993. As a historical trend of productivity in the BMT unit, the number of transplants has been steadily increasing from 33 in FY93 to 36 in FY94 and finally 41 in FY95. However, this is due to an increase in the number of adult BMT cases [19 (FY93), 21 (FY94), 31 (FY95)] which may be related to a greater number of breast cancer BMT cases. All of the adult patients received autologous BMT. Pediatric patients had both autologous and allogeneic BMT.

As Table 1 indicates, BAMC BMT unit average total direct and indirect costs for FY95 were \$77,603 per BMT patient. This figure was determined by dividing the total BMT unit costs of \$3,181,746 for transplant patients by the total number of BMT dispositions (41). The ALOS for these patients was 43 days. Jacobs (1991) notes that the task of a cost-effectiveness analysis is to rank alternative treatments on the basis of cost per unit of output. In the case of BMT, the total cost per BMT patient will be the basis for comparison of the cost-effectiveness of each alternative. However, Jacobs (1991) also adds that "because dollar values are not placed on health outcomes, cost-effectiveness cannot tell us whether something is worth doing". For this reason, other qualitative issues will be discussed which potentially impact on the final decision.

A comparison of hospital length of stay of the 31 adult autologous BMT to the 10 pediatric BMT (6 autologous and 4 allogeneic) showed an ALOS of 41 days for the adult BMT cases whereas the pediatric autologous BMT cases had an ALOS of 65 days and pediatric allogeneic BMT cases had an ALOS of 72 days. Since the pediatric BMT patients required a much longer hospitalization, they consequently had a higher total cost per patient. The adult autologous BMT cases had an average total cost of \$68,833 whereas pediatric autologous BMT cases had average total cost of \$103,339 and pediatric allogeneic BMT cases had an average total cost of \$106,968. As these figures indicate, the average cost of the pediatric BMT cases was much more expensive than the average cost of the adult BMT cases for FY95 at BAMC. WHMC did not perform any pediatric BMT cases during FY95 so a more

accurate cost-effectiveness comparison should be between adult BMT cases at BAMC and WHMC. In comparing both adult and pediatric BAMC BMT cost to the CHAMPUS billed and paid costs listed in Appendix E (average billed \$215,632; paid \$108,771) and Appendix F (average billed 232,403; paid \$176,548), the BAMC BMT unit average costs per case are much lower. The BAMC BMT unit costs are also lower than the estimated autologous BMT charges (\$138,698), for a similar ALOS (40 days), given in the literature (Appendix B).

Since BAMC has applied for STS status for breast cancer BMT, those costs will also be addressed. Fourteen autologous BMT for breast cancer were done at BAMC during FY95. At the current time, breast cancer is not an eligible diagnosis for BMT under CHAMPUS guidelines. Because of this, BAMC is providing these military beneficiaries a tremendous service by offering BMT services which they would not otherwise receive without a huge cost to themselves. At BAMC during FY95, the average cost of autologous BMT for breast cancer was \$65,465. This figure includes average travel costs since STS status implies a national referral base. The ALOS for these patients was 35 days. This is less than the 41 day ALOS for all of the adult autologous BMT patients on the unit.

The BAMC BMT unit at the new hospital is an eight bed ward which is currently staffed for six patients. All of the rooms have high efficiency particulate air (HEPA) filtration with positive air pressure. A state-of-the-art bone marrow laboratory, under the Department of Clinical Investigation, gives support to the unit. The lab is in very close proximity to the BMT unit.

Manpower studies determined that the BMT ward should have 20 full time staffing requirements. At the present time, the unit fulfills that staffing guideline and is in the process of hiring two additional registered nurses which will improve the nurse to patient staffing ratio. Since this unit primarily performs autologous BMT, the guide of one nurse to three patients should easily be accomplished. After evaluating Table 2, it can be seen that the unit seldom has more than four patients at one time. The staffing shown in Table 3 is consistent with the manpower requirements of eight to nine registered nurses, eleven paraprofessionals, and one to two administrative support personnel.

The decision to move the Pediatrics GME Program to WHMC directly impacts on the BAMC BMT unit. Pediatrics will have a forty-six bed ward and a nine bed Pediatrics intensive care unit at WHMC. Although there will still be a Pediatrics outpatient clinic at BAMC, there will no longer be any inpatient Pediatrics capability. Also, the Pediatrics staff will be primarily located at WHMC. Because there will no longer be any Pediatrics support staff at BAMC, pediatric BMT will move to WHMC. WHMC has projected that the new Pediatric BMT unit will require one Nurse Manager, six staff nurses (based on a ratio of one nurse to two patients), one clerical staff, one NCOIC, and three to five technicians (based on 0.5 technicians per patient).

The second alternative proposal is that the consolidated BMT unit should be totally relocated to WHMC. As stated above, all pediatric BMT will be moved to WHMC because the Pediatrics GME program and all Pediatrics support staff are

now located there. The issues concerning pediatric BMT were addressed previously. Factors concerning adult BMT will now be considered. WHMC has been doing BMT since 1982 when they performed their first autologous BMT (Leff, Thompson, and Messerschmidt 1988). WHMC has been designated as a STS for adult BMT. The WHMC BMT unit is a 13 bed ward. All rooms on the BMT unit are HEPAfiltered and there are also an additional 10 HEPAfiltered rooms available on the Hematology/Oncology ward.

Oncologists from WHMC were concerned that there were not a sufficient number of HEPAfiltered rooms available at BAMC for the projected number of transplant patients if all BMT was moved to BAMC. They felt that it was the standard of care for neutropenic cancer patients to be placed in private rooms with positive pressure air flow to avoid potential infection. The literature (Whedon 1991) states that many approaches have been utilized to prevent infections in BMT recipients. These preventive techniques include laminar air-flow rooms, HEPAfiltration, and reverse or protective isolation in which the patient is isolated in a standard private room with the staff wearing face masks with good handwashing procedures. All of the eight patient rooms on the BMT ward in the new BAMC have positive pressure air-flow with HEPAfiltration and the staff follows all infection prevention measures. Because of this, BAMC meets the recommended infection control guidelines. In any case, the literature (Whedon 1991) also notes that there were no significant differences in the incidence of infections between patients in a laminar air flow environment and patients receiving standard reverse isolation

procedures.

Other concerns voiced by the WHMC Oncology staff involved bathroom facilities. They believed that each BMT patient room must have separate toilet facilities because of the high risk of infection. The "pullout toilets" in the BAMC BMT unit are not adequate in their estimation. Kelleher and Jennings (1988) discuss the recommended BMT unit design and generally describe that patient rooms have toilet and shower for personal hygiene, in addition to, sinks, with foot pedals preferred, for handwashing. The BAMC BMT unit meets those criteria.

WHMC only performed adult BMT during FY95 of which 30 were adult allogeneic BMT and 27 were adult autologous BMT as is shown in Table 4. The total average cost per BMT patient was \$65,520 and this is the amount that will be used in the cost-effectiveness comparison. The ALOS was 22 days for adult autologous BMT patients and 36 days for adult allogeneic BMT patients.

The WHMC BMT unit currently performs a ratio of approximately half adult autologous and half adult allogeneic BMT. The WHMC BMT unit staffing, given in Table 5, adequately supports all aspects of patient care in that BMT unit. Staffing for pediatric BMT will be additional since that function was not done prior to this time at WHMC. Up to the present time, CHAMPUS Statements of Nonavailability were given for pediatric BMT if it could not be accommodated at BAMC. WHMC Oncology staff have expressed concern that BAMC does not have the qualified medical personnel to run an adult allogeneic BMT program. However, this is not a valid statement. As O'Rourke (1995) wrote, the senior leadership of a combined

Hematology-Oncology BMT Service is present at BAMC. It has the most experienced and senior pediatric transplant physician who would support the pediatric BMT program whether it were at BAMC or WHMC. Also, BAMC has the most experienced and senior adult BMT transplant physician in the military who is trained in allogeneic techniques although BAMC is currently only performing adult autologous transplants.

A cost-effectiveness analysis between the cost per BMT patient at BAMC and WHMC will compare only adult BMT patients since WHMC did not treat any pediatric BMT patients during FY95. BAMC adult BMT cases had an average total cost per patient of \$68,833. WHMC adult BMT cases had an average total cost per patient of \$65,520. Both of these costs were significantly less than the average BMT CHAMPUS billed and paid costs for FY93 (billed \$215,632; paid \$108,771) and FY94 (billed \$232,403; paid \$176,548). The average total costs per BMT patient at BAMC and WHMC were also much less than the costs estimated in the literature (Whedon 1991) for an autologous BMT with an ALOS of 40 days (\$138,698). The cost-effectiveness analysis indicates very little difference in the average cost per BMT patient at BAMC and WHMC. They are both very cost-effective facilities in terms of providing BMT treatment. These military medical centers are both much more cost-effective in treating BMT patients than the civilian sector.

The ALOS for BAMC adult autologous BMT patients was 41 days for FY95. This a longer length of stay than that of either the autologous (ALOS 22 days) or the allogeneic (ALOS 36 days) BMT patients from WHMC during the same time period.

As noted earlier, allogeneic BMT patients have a higher risk of complications developing following BMT and consequently tend to have longer lengths of stays in the hospital compared with autologous BMT patients. The longer ALOS of BAMC BMT patients, as compared with WHMC patients, may be due to the use by WHMC of an outpatient chemotherapy service to complete treatments of BMT patients after discharge. This allows for shorter inpatient lengths of stays for their patients. Prior to the move into the new hospital, BAMC did not have the capability to treat BMT patients on an outpatient basis. However, the new BAMC facility has a 23 Hour Observation Ward which can possibly be used to complete BMT therapies. In this case, BMT patients could be discharged earlier and subsequently decrease hospital lengths of stays.

The third alternative is to leave adult BMT units in place at both BAMC and WHMC. In this case, there is also the mandatory requirement to move the pediatric BMT unit to WHMC as a consequence of the Pediatrics GME training program being located at WHMC. As the cost-effectiveness analysis has demonstrated, both of these institutions are extremely cost-effective in providing BMT treatment. A main consideration of this alternative is whether the patients, who are currently being given CHAMPUS non-availability statements for BMT due to insufficient capability of the military facilities to treat them, could be treated in one of these two military hospitals if both BMT units continue, or possibly expand, at BAMC and WHMC. This could be a tremendous cost-avoidance measure in terms of CHAMPUS costs. Another important advantage of this alternative is being able to create access for

military beneficiaries to BMT treatment for diagnoses that are not allowed BMT under CHAMPUS guidelines, such as is currently the case for breast cancer.

This third alternative would have the same cost-effectiveness in terms of cost per patient as the previous two alternatives. WHMC will have the additional cost of setting up a pediatric BMT unit but that will have to be done in any case so it is not a relevant factor to this alternative. Since WHMC already has an additional ten rooms equipped with HEPAfilters on the Hematology/Oncology ward, an increased number of BMT patients can be readily accepted by them without greatly added cost. WHMC mainly indicates that it requires six pediatric specialized nurses to handle the additional pediatric BMT workload.

Based on CHAMPUS non-availability statements, during FY95 eighteen adult allogeneic BMT patients, two adult autologous BMT patients, and ten pediatric allogeneic BMT patients were sent into the civilian sector for BMT. These are the patients that could be maintained in the military health care system for treatment at much lower government cost. These patients also contribute to the GME training mission by providing expertise to residents and fellows in the area of BMT. Additionally, BAMC has applied for STS designation for high-dose chemotherapy with autologous stem-cell rescue (BMT) for breast cancer. These patients would not be able to receive BMT under CHAMPUS guidelines. As Appendix C indicates, there were a total of 23 of the 41 (56%) BMT cases treated at BAMC during FY95 that were not CHAMPUS-eligible. A prime consideration of this third alternative is to be able to expand BMT services to this population of people who can not receive

BMT in civilian hospitals because their diagnosis will not receive reimbursement under CHAMPUS. CHAMPUS recapture initiatives may become less of an incentive now that TRICARE has become the new health care program of military beneficiaries. Dr. Stephen Joseph (1995) states that "TRICARE pulls together the health care systems of the Military Departments and CHAMPUS in a cooperative and supportive effort to better use the resources available to military medicine." TRICARE attempts to change both provider and patient behavior in order to provide the optimum health care quality and access while controlling costs (McGee and Hudak 1995).

Based on FY95 BMT numbers, 57 BMT were performed at WHMC, 41 BMT were done at BAMC, and approximately 30 patients were sent to civilian hospitals for BMT treatment. The cost-effectiveness analysis indicates that both BAMC and WHMC are very cost-effective in providing BMT treatment. However, in order to maintain the present workload and potentially increase the number of patients to include those currently being sent to civilian facilities, BMT units need to be retained at both BAMC and WHMC. The ten additional HEPAfiltered rooms on the WHMC Hematology/Oncology ward could be used to absorb any additional workload.

## **CHAPTER 5**

### **CONCLUSIONS AND RECOMMENDATIONS**

This study evaluated the question of whether BAMC and WHMC would be more cost-effective and efficient in providing BMT services to eligible military beneficiaries either by totally consolidating the BMT units of BAMC and WHMC at one facility or by providing BMT treatment at both hospitals. The prior discussion has reviewed the three alternative situations that can occur. The cost-effectiveness analysis has demonstrated that both BAMC and WHMC are extremely cost-effective and efficient in their delivery of BMT treatment. Both of these military hospitals are able to provide BMT services to their patients at a much lower cost to the government than similar treatment in the civilian sector. The conclusion of this analysis is that it appears that there are distinct advantages to keeping the BMT units at both BAMC and WHMC rather than consolidating them at one location.

Some of the advantages have already been referred to in the discussion of the third alternative which advocates the retention of BMT units at BAMC and WHMC. These two BMT units support not only San Antonio or the Great Plains Health Service Support Area but also potentially all of DoD. WHMC is already a STS referral center for adult BMT and BAMC has applied for STS designation for high-dose chemotherapy with autologous stem cell rescue (BMT) for breast cancer. These

medical centers receive patients from throughout the country and from all military services. Up to the present time, each hospital had a specific area of BMT on which it tended to concentrate. BAMC was treating both autologous and allogeneic pediatric BMT as well as adult autologous BMT patients whereas WHMC specialized in adult allogenic BMT cases but treated adult autologous BMT patients as well. Almost half of the adult autologous BMT patients treated at BAMC had a diagnosis of breast cancer. With the shift of the Pediatrics GME training program to WHMC, the pediatric BMT will move there also. Since BAMC has applied for STS designation in BMT for breast cancer patients, it will most likely still have a predominance of those patients. WHMC will continue to treat the adult allogenic BMT patients. BAMC and WHMC have established referral patterns for BMT and can also refer to each other depending on space availability.

There has been an increasing demand for transplants. The high inpatient census of the BMT wards, and still the need for CHAMPUS Statements of Non-availability, indicate that the need for both BMT units is present. If one of the units were closed, there will be a loss of physician, nurse, laboratory, and support personnel due to the consolidation. However, economies of scale will not be gained. All of the findings demonstrate that a single BMT unit will not be as effective as the two current units. Workload will probably be lost since the patients will not be able to access the system. In that case, more patients will either be sent out to CHAMPUS for treatment at a much greater governmental expense or not receive BMT treatment due to a CHAMPUS-ineligible diagnosis.

Both BAMC and WHMC have excellent GME training programs which are now in the process of integrating. The presence of BMT units at both hospitals will enhance GME training not only to the Hematology/Oncology Service but also to services which provide consults to the BMT patients. Since GME is a prime mission of both BAMC and WHMC, it needs to be considered as part of this overall analysis.

The recommendation that this study supports is that the BMT units at both BAMC and WHMC should be retained. These units are very cost-effective and efficient. They can provide BMT treatment to patients at much less cost to the government than if those cases were treated at civilian hospitals. The analysis does not indicate any specific economies of scale gained by consolidating the units at one location. The study does show that the presence of two BMT units may enhance patient access into the military system. This could decrease the need for CHAMPUS non-availability statements and allow patients who are ineligible for BMT under CHAMPUS guidelines to receive treatment.

## **APPENDIX A**

### **DEFINITION OF TERMS**

Allogeneic Bone Marrow Transplantation- the bone marrow for the transplant comes from a person other than the patient, usually a sibling or parent.

Autologous Bone Marrow Transplantation- the patient's own bone marrow is used as a source of hematopoietic stem cells to replenish the marrow cell population which was depleted by high doses of anti-cancer therapy.

Average Length of Stay (ALOS)- total occupied bed days divided by the total number of dispositions.

Bone Marrow Transplantation- the intravenous infusion of hematopoietic progenitor cells to reestablish marrow function in a patient with damaged or defective bone marrow. It is usually used in patients with certain forms of cancer.

CHAMPUS- Department of Defense Civilian Health and Medical Program for the Uniformed Services.

Cost-Benefit Analysis- an analysis that allows comparison of cost versus benefits of programs having objectives which are not necessarily similar.

Cost-Effectiveness Analysis- an analysis which permits comparison of cost per unit of effectiveness among competing program alternatives designed to serve the same basic purpose.

Descriptive Research- to describe systematically the facts and characteristics of a given population or area of interest, factually and accurately.

Diagnosis Related Groups (DRG)- a statistical system of classifying any inpatient stay into groups for purposes of payment.

Disposition- discharges from the hospital.

Glioma- any neoplasm derived from one of the various types of cells that form the interstitial tissue of the brain.

Hematology- the medical specialty that pertains to the anatomy, physiology, pathology, symptomatology, and therapeutics related to the blood and blood-forming tissues.

Hodgkin's Disease- a malignant neoplasm of lymphoid cells marked by chronic enlargement of the lymph nodes, spleen, and often the liver.

Leukemia- progressive proliferation of abnormal white blood cells. It is classified by the dominant cell type and by duration from onset to death.

Lymphoma- a neoplastic disorder of the lymphoid tissue.

Medical Expense and Performance Reporting (MEPR) System- a uniform expense and manpower reporting system in Department of Defense fixed military medical and dental treatment facilities that provides standardized expense and manpower data for management of health care resources.

Medical Work Unit (MWU)- a combination of inpatient and ambulatory work units used in the MEPR system. The inpatient work units are based on dispositions and a numerical weighted value that is unique to each treatment facility. Total inpatient work units are determined by multiplying the weighted value by the total number of dispositions from each unit. Ambulatory work units are based on the total number of clinic visits weighted for each particular type of clinic.

Multiple Myeloma- a malignant neoplasm that originates in bone marrow.

Myelodysplasia- defective development of any part of the spinal cord.

Neuroblastoma- sarcoma of nervous system origin composed chiefly of neuroblasts and affecting mostly infants and children up to ten years of age.

Neutropenia- the presence of abnormally small numbers of neutrophils (mature white blood cells) in the circulating blood.

Occupied Bed Days- total inpatient census for the unit.

Oncology- the science or study dealing with the physical, chemical, and biologic properties and features of neoplasms (abnormal tissues or tumors).

Specialized Treatment Services (STS)- a designation given to an organization for specific complex medical care involving high-cost and high-technology procedures that is best delivered in medical centers of excellence in order to ensure the most favorable patient outcomes and to conserve resources.

TRICARE- Department of Defense program offering military beneficiaries a choice of three health care benefit packages that include TRICARE Prime (health maintenance organization), TRICARE Extra (preferred provider organization), and standard CHAMPUS.

Wilm's Tumor- a rapidly developing malignant mixed tumor of the kidneys that usually affects children before the fifth year of life.

## **APPENDIX B**

### **LITERATURE COST ESTIMATE OF AUTOLOGOUS BONE MARROW TRANSPLANT CHARGES EXPECTED FOR TRANSPLANTATION ADMISSION (Expected Length of Stay: 40 Days)**

<u>Procedure</u>	<u>Cost</u>
Medications	\$50,914
Blood products	30,598
Routine days	18,792
Laboratory	18,390
Med/Surg supplies	6,466
Intensive Care	5,343
Radiology	2,309
Intravenous therapy	2,360
Respiratory therapy	886
Operating room	857
Radiation therapy	720
Anesthesia	208
Recovery room	205
Physical therapy	196
Nuclear medicine	141
Ultrasound	101
ECG/Stress/Holter	78
Echocardiography	71
Cardiopulmonary	46
<u>Same day services</u>	<u>17</u>
<b>Total</b>	<b>\$138,698</b>

(Whedon 1991)

## APPENDIX C

### **BAMC BONE MARROW TRANSPLANTATION UNIT WORKLOAD (FISCAL YEAR 1995)**

Patient	Service	Diagnosis	BMT Type	CHAMPUS	LOS
1	Adult	BC	Auto	No	29
2	Adult	BC	Auto	No	30
3	Adult	BC	Auto	No	39
4	Adult	BC	Auto	No	31
5	Adult	BC	Auto	No	26
6	Adult	BC	Auto	No	35
7	Adult	BC	Auto	No	33
8	Adult	BC	Auto	No	56
9	Adult	BC	Auto	No	35
10	Adult	BC	Auto	No	31
11	Adult	BC	Auto	No	33
12	Adult	BC	Auto	No	58
13	Adult	BC	Auto	No	28
14	Adult	BC	Auto	No	27
15	Peds	ALL	Allo	Yes	115
16	Peds	ALL	Allo	Yes	87
17	Adult	NHL	Auto	Yes	38
18	Adult	NHL	Auto	Yes	48
19	Peds	Neuroblastoma	Auto	Yes	41
20	Adult	NHL	Auto	Yes	37
21	Adult	NHL	Auto	Yes	31
22	Peds	Wilm's Tumor	Auto	No	75
23	Peds	ALL	Allo	Yes	39
24	Adult	TC	Auto	No	47
25	Adult	NHL	Auto	Yes	51
26	Adult	HD	Auto	No	50
27	Adult	AML	Auto	Yes	89
28	Adult	Ovarian Cancer	Auto	No	37
29	Peds	Neuroblastoma	Auto	Yes	92
30	Adult	Ovarian Cancer	Auto	No	40
31	Adult	NHL	Auto	Yes	45
32	Peds	BSG	Auto	No	61
33	Adult	NHL	Auto	Yes	31
34	Peds	Wilm's Tumor	Auto	No	62
35	Adult	NHL	Auto	Yes	33
36	Peds	Myelodysplasia	Allo	Yes	48
37	Adult	Multiple Myeloma	Auto	No	35
38	Adult	NHL	Auto	Yes	44
39	Adult	Multiple Myeloma	Auto	No	35
40	Adult	NHL	Auto	Yes	44
41	Peds	AML	Auto	Yes	56

ALL: Acute Lymphocytic Leukemia

AML: Acute Myelogenous Leukemia

BC: Breast Cancer

BSG: Brain Stem Glioma

HD: Hodgkin's Disease

NHL: Non-Hodgkin's Leukemia

TC: Testicular Cancer

BMT Type: Auto: Autologous

Allo: Allogeneic

CHAMPUS: BMT CHAMPUS-eligible

LOS: Hospital Length of Stay

## **APPENDIX D**

### **BAMC BONE MARROW TRANSPLANTATION UNIT BREAST CANCER CASES (FISCAL YEAR 1995)**

<u>Patient</u>	<u>Direct Costs</u>	<u>Indirect Costs</u>	<u>Total</u>
1	\$ 30,726	\$ 13,869	\$ 44,595
2	31,931	14,347	46,278
3	45,888	18,651	64,539
4	41,107	14,825	55,932
5	37,695	12,434	50,129
6	43,574	16,738	60,312
7	39,466	15,782	55,248
8	64,504	26,782	91,286
9	44,641	16,738	61,379
10	56,226	14,825	71,051
11	47,173	15,782	62,955
12	73,624	27,738	101,362
13	35,158	13,391	48,549
14	<u>35,893</u>	<u>12,912</u>	<u>48,805</u>
<b>TOTAL</b>	<b>\$ 627,606</b>	<b>\$ 234,814</b>	<b>\$ 862,420</b>

Average Direct Costs Per Case: \$44,829

Average Indirect Costs Per Case: \$16,772

Average Travel Costs Per Case: \$3,864

**Average Total Costs Per Breast Cancer Case= Average Direct Costs + Average Indirect Costs + Average Travel Costs: \$65,465**

**Average Length of Stay (ALOS) Per Breast Cancer Case: 35 Days**

## **APPENDIX E**

### **CHAMPUS DATA FOR DRG 481 (BONE MARROW TRANSPLANT) FISCAL YEAR 1993 (Cases Grouped by Catchment Area)**

<u>Case</u>	<u>Episode Billed Amount</u>	<u>Government Paid Amount</u>
1	\$ 347,968	\$ 130,243
1	232,827	3,729
1	76,666	68,925
1	78,880	94,732
1	112,123	46,621
1	78,899	67,032
1	132,017	74,199
5	979,176	527,864
2	436,093	176,480
5	1,507,252	368,249
2	664,702	246,943
4	1,098,889	1,065,289
1	154,660	148,995
2	329,945	134,289
<u>1</u>	<u>23,233</u>	<u>781</u>
<b>Total:</b> 29	<b>\$ 6,253,330</b>	<b>\$ 3,154,371</b>

**Average Episode Billed Amount: \$215,632**

**Average Government Paid Amount: \$108,771**

## **APPENDIX F**

### **CHAMPUS DATA FOR DRG 481 (BONE MARROW TRANSPLANT) FISCAL YEAR 1994**

<u>Case</u>	<u>Episode Billed Amount</u>	<u>Government Paid Amount</u>
1	\$ 220,380	\$ 76,340
2	763,770	732,301
3	133,425	130,309
4	281,099	259,192
5	558,377	494,967
6	425,301	396,874
7	737,727	706,227
8	121,588	60,450
9	123,862	105,206
10	524,565	222,833
11	234,650	88,755
12	28,962	28,432
13	133,331	125,715
14	197,029	188,567
15	368,021	149,033
16	323,887	99,996
17	152,195	79,958
18	157,014	135,275
19	295,480	271,881
20	517,825	489,795
21	110,876	110,121
22	97,977	96,755
23	112,172	103,434
24	120,349	68,495
25	124,529	113,944
26	161,511	155,304
27	211,575	190,039
28	122,296	64,054
29	141,368	106,792
30	279,204	99,337
31	150,246	84,969
32	307,816	104,796
33	62,374	57,681
34	164,206	157,085
35	86,572	78,097
36	96,545	81,360
37	141,073	112,646
38	115,610	110,926
39	<u>158,946</u>	<u>147,458</u>
<b>Total:</b>	<b>39</b>	<b>\$ 9,063,733</b>
		<b>\$ 6,885,399</b>

**Average Episode Billed Amount: \$232,403**

**Average Government Paid Amount: \$176,548**

## REFERENCES

- Allerton, Jeffrey P. and Stacy K. Lewis. 1995. Letter to Colonel Perucca, 19 July. Establishment of DoD Cancer Center, San Antonio, Texas.
- Armitage, James O. 1994. Bone marrow transplantation. *The New England Journal of Medicine* 330 (12): 827-38.
- Assistant Secretary of Defense (Health Affairs). 1986. *Medical Expense and Performance Reporting (MEPR) System for fixed military medical and dental treatment facilities*: DoD-D-6010.13. National Technical Information Service, Washington, D. C.
- Boex, James R. 1992. Factors contributing to the variability of direct costs for graduate medical education in teaching hospitals. *Academic Medicine* 67 (2): 80-4.
- Burkhalter, Edward L. 1996. Graduate medical education in the Department of Defense. *Military Medicine* 161 (February): 102-4.
- Cameron, James M. 1985. The indirect costs of graduate medical education. *The New England Journal of Medicine* 312 (19): 1233-8.
- CHAMPUS Policy Manual. 1991. Bone Marrow Transplants: Revision No. 5. *OCHAMPUS 6010.47M, CHAMPUS Policy Manual*, Vol. I, Chapter 3, Sec. 6.38245.1: 38245.1.1-38245.1.5.
- Diamond, Herbert S., Larry L. Fitzgerald, and Richard Day. 1993. An analysis of the cost and revenue of an expanded medical residency. *Journal of General Internal Medicine* 8 (November): 614-8.
- Dunn, Michael, Director of Clinical Consultation OASD (HA). 1995. Briefing on Specialized Treatment Services Program. 17 October, Fort Sam Houston, Texas.
- Eiseman, Ben. 1995. Government-provided health care: a prediction. *Archives of Surgery* 130 (July): 728-31.

- Federal Register. 1993. Specialized Treatment Services Program: Final rule. *Federal Register*, November 5, FR Document 93-27050, 58: 58955-64.
- Fernandez-Bueno, Carlos, Timothy R. Shaver, and James R. Baker, Jr. 1990. Transplantation in the military: State of the art- A progress report from the Army-Navy transplant program. *Military Medicine* 155 (9): 411-3.
- Giles, Kent, Mary Nell Winslow, and William P. Vaughan. 1994. The single-staff model for bone marrow transplantation. *Physician Executive* 20 (11): 34-7.
- Griffiths, R. I., E. B. Bass, N. R. Powe, G. F. Anderson, S. Goodman, and J. R. Wingard. 1993. Factors influencing third party payer costs for allogeneic BMT. *Bone Marrow Transplantation* 12 (July): 43-8.
- Hillner, Bruce E., Thomas J. Smith, and Christopher E. Desch. 1992. Efficacy and cost-effectiveness of autologous bone marrow transplantation in metastatic breast cancer. *JAMA* 267 (15): 2055-61.
- Holoweiko, Mark. 1995. What to watch out for when your local hospitals merge. *Business and Health* 13 (10): 26-34.
- Isaac, Stephen and William B. Michael. 1981. *Handbook in Research and Evaluation*, (Second Edition). San Diego, CA: Edits Publishers.
- Jacobs, Philip. 1991. *The Economics of Health and Medical Care*, (Third Edition). Gaithersburg, MD: Aspen Publishers, Inc.
- Joint Healthcare Manpower Development Study. 1992. *Medical Surgical Inpatient Nursing Services, DoD 6300-STD*, 24 January. DoD Joint Healthcare Management Engineering Team, San Antonio, TX.
- Joseph, Stephen C. 1995. About TRICARE. *Military Medicine* 160 (10): A12.
- Kelleher, Joleen and Marilyn Jennings. 1988. Nursing management of a marrow transplant unit: A framework for practice. *Seminars in Oncology Nursing* 4(1): 60-8.
- Kindig, David A. and Donald Libby. 1994. How will graduate medical education reform affect specialties and geographic areas? *JAMA* 272 (1): 37-42.
- Leff, R. S., J. M. Thompson, and G. L. Messerschmidt. 1988. Bone marrow transplantation: major advance in cancer therapy. *Aviation, Space, and Environmental Medicine* 59 (November): A83-6.

- Lie, Reidar K. 1994. Experimental treatment, values and rationing. *Social Science and Medicine* 39 (8): 1011-4.
- Manpower Modeling and Requirements Branch. 1994. *Manpower Staffing Assessment: Brooke Army Medical Center, Fort Sam Houston, TX, July 1994*. U. S. Army Medical Command, Fort Sam Houston, TX.
- Markin, Rodney S. 1992. The impact of transplantation on the clinical laboratory: Experience at the University of Nebraska with bone marrow and liver transplantation. *Archives of Pathology and Laboratory Medicine* 116 (October): 1004-11.
- Maynard, Gary, Mary D. Lagerwey, Joan M. Wendling, and David Kindig. 1995. Medical staff consolidation issues and concerns. *Hospital & Health Services Administration* 40 (3): 348-61.
- McGee, William M. and Ronald P. Hudak. 1995. Reengineering medical treatment facilities for TRICARE: The Medical Group Practice Model. *Military Medicine* 160 (5): 235-9.
- National Cancer Institute. 1994. *Bone marrow transplantation and peripheral blood stem cell transplantation*. U. S. Department of Health and Human Services, NIH Publication Number 95-1178 (HE 20.3166: B 64/994).
- Naughton, John and Joyce E. Vana. 1994. The academic health center and the healthy community. *American Journal of Public Health* 84 (July): 1071-6.
- Oglivie, Claudia A. 1993. Memorandum for Chief, DCS Resource Management, U. S. Army Health Services Command, 2 September. Bone Marrow Transplant-FASS Data, Fort Sam Houston, Texas.
- Optenberg, Scott A. and James M. Thompson. 1993. *Allogeneic and autologous bone marrow transplantation in CHAMPUS 1989-1993*. Fort Sam Houston , TX: Health Care Studies and Clinical Investigation, Tri-Service CHAMPUS Statistical Database Report No. RP 94-002.
- O'Rourke, Timothy J. 1995. Memorandum for Commander and Deputy Commander, BAMC, 22 August. Army and Air Force Bone Marrow Transplant Units in the San Antonio Area, Fort Sam Houston, Texas.
- Peters, William P., and Mark C. Rogers. 1994. Variation in approval by insurance companies of coverage for autologous bone marrow transplantation for breast cancer. *The New England Journal of Medicine* 330 (7): 473-7.

- Riffer, Joyce. 1986. Physician input crucial in hospital merger talks. *Hospitals* 60 (20 September): 78.
- Schwab, Linda. 1991. Investigators, insurers consider marrow transplant issues. *Journal of the National Cancer Institute* 83 (16): 1136-7.
- Tapatio Springs Military Medical Executive Conference. 1995. *Key issues relating to medical services and GME integration: Brooke Army Medical Center, Wilford Hall Medical Center, and Darnall Army Community Hospital*, August 24. Boerne, Texas.
- Task Force Aesculapius. 1995. *United States Army Medical Department Reorganization: Volume I Narrative*. Falls Church, VA.: Office of the Surgeon General.
- Udvarhelyi, Steven, Graham A. Colditz, Arti Rai, and Arnold M. Epstein. 1992. Cost-effectiveness and cost-benefit analyses in the medical literature. *Annals of Internal Medicine* 116 (3): 238-44.
- Warner, Kenneth E. and Rebecca C. Hutton. 1980. Cost-benefit and cost-effectiveness analysis in health care. *Medical Care* 18 (11): 1069-84.
- Whedon, Marie Bakitas. 1991. *Bone marrow transplantation: principles, practice, and nursing insights*. Boston: Jones and Bartlett Publishers, Inc.
- Wingard, John R. 1994. Variations in insurance coverage for autologous bone marrow transplantation for breast cancer: editorial reply. *The New England Journal of Medicine* 331 (5): 330.